Department of Architecture
School of Engineering
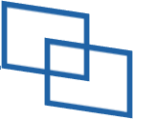The University of Tokyo
Building Material Laboratory

Effect of Temperature and Humidity on Corrosion Rate of Reinforcing Steel Bars Embedded in carbonated cement-based material
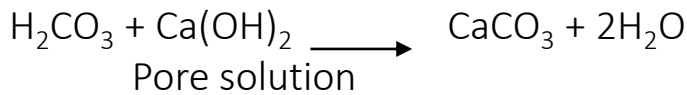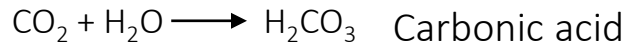
D1

Cheng Luge

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Background

- carbonation is a major cause of evaluating life span of concrete structures

PH (12 or 13)

$CO_2 + H_2O \longrightarrow H_2CO_3$ Carbonic acid

$H_2CO_3 + Ca(OH)_2 \longrightarrow CaCO_3 + 2H_2O$
Pore solution

PH (9)

Passive layer is unsustainable

- Suffer from various RH and T

Macrocells can also form <u>on a single bar</u> (exposed to different environments within the concrete / extends outside the concrete)

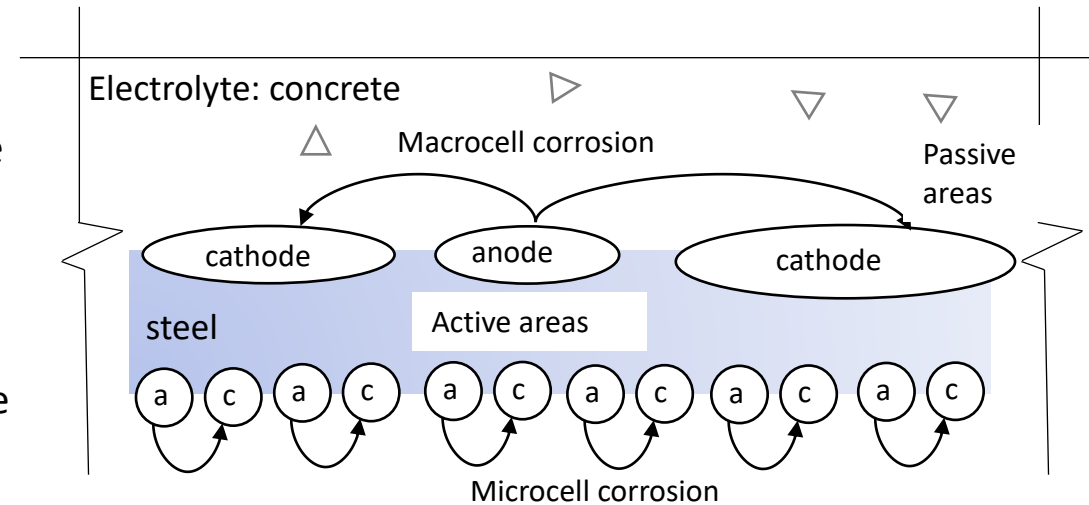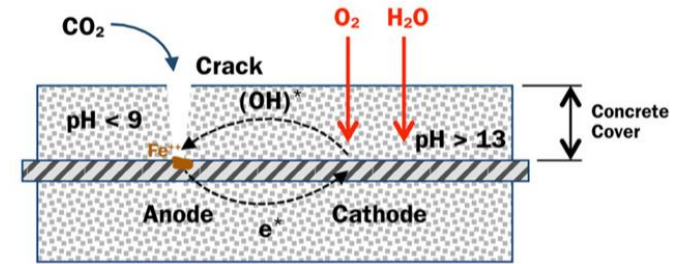<u>Continuous reinforcement</u> is required due to low tensile strength of concrete

CO_2 Crack O_2 H_2O
$pH < 9$ $(OH)^-$ Concrete Cover
Fe^{2+} $pH > 13$
Anode e^- Cathode

Electrolyte: concrete

Macrocell corrosion

Passive areas

cathode   anode   cathode

steel   Active areas

a c a c   a c a c a c a c

Microcell corrosion

Schematic illustration of microcell and microcell corrosion

Purpose

w/b ratio   Cover depth   Binder type   Steel type

Constant RH/cyclic   temperature   Mill scale
wet and dry

factors $\dfrac{influence}{\quad}$ Corrosion rate

Macrocell

Microcell

(Carbonated & chloride-induced)

Corrosion prediction system (contribute to the understanding of corrosion mechanism)